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Original Article

Subdural versus subgaleal drains: Impact on postoperative complications and length of stay following subdural hematoma evacuation

Adam Vacek[1], Madeline Hawkins[1], Kiara Garg[2], Kashif Majeed[1,3], Mohit Arora[1]

[1]Department of Neurosurgery, Aberdeen Royal Infirmary, [2]Aberdeen University Medical School, Aberdeen, [3]Nuffield Department of Surgical Sciences, University of Oxford, Oxford, United Kingdom.

E-mail: *Adam Vacek - adam.vacek4@nhs.scot; Madeline Hawkins - mdl.hawkins@gmail.com; Kiara Garg - k.garg.20@abdn.ac.uk; Kashif Majeed - kashif.majeed@nhs.scot; Mohit Arora - mohit.arora1@nhs.scot

***Corresponding author:**
Adam Vacek,
Department of Neurosurgery,
Aberdeen Royal Infirmary,
Aberdeen, Aberdeenshire,
United Kingdom.

adam.vacek4@nhs.scot

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ABSTRACT

Background: Subdural hematoma (SDH) is a common neurosurgical pathology, typically managed surgically in symptomatic cases. We aimed compare postoperative outcomes between subdural and subgaleal drain placements in SDH patients at single Scottish neurosurgical centre.

Methods: Retrospective chart review of all non-acute SDH cases undergoing surgery between October 2022 and August 2024 undertaken. Patients were identified using ICD-10 codes and confirmed via electronic records. Their post-operative course, and the length of stay were compared between the two drain types.

Results: Among the 55 SDH cases, 48 (87.3%) were males and 7 (12.7%) females. The mean age was 75 years (range 22-87, SD=10.93). Nine (16.4%) cases were subacute, 15 (27.3%) acute-on-chronic, and 31 (56.4%) were chronic. Forty one patients (74.5%) underwent unilateral burr hole evacuation, 6 (10.9%) had bilateral hematoma evacuation and 7 (12.7%) had mini-craniotomy. Only 1 (1.8%) patient had a standard craniotomy. Among these, 23 (41.8%) had subgaleal and 32 (58.2%) had subdural drains. Mean drain duration was 2 days (range 1-4, SD 0.52). Post-op complications included hematoma recurrence (20%), infections (7.3%), seizures (14.5%), pneumocephalus (73.5%) and scalp swelling (3.6%). One post-op death occurred. The median hospital stay was 7 days, with mean modified Rankin Scale at discharge of 2.5. No statistically significant differences were observed in recurrence (OR=0.76, p=0.75), infections (OR=0.45, p=0.63), pneumocephalus (OR=1.27, p=0.76), seizures (OR=0.17, p=0.12), or length of hospital stay (Z=-1.47, p=0.14) between the two drain types.

Conclusion: Subdural and subgaleal drains yielded no significant differences in the rates of recurrence, post-operative infections, and length of hospital stay in this cohort.

Keywords: Clinical outcomes, Length of stay, Subdural hematoma, Subdural drain, Subgaleal drain, Postoperative complications

INTRODUCTION

Subdural hematoma (SDH) is one of the most frequently encountered pathologies in neurosurgery with an incidence of 8.2–14.0/100,000 persons.[11] Advancing age is a significant risk factor in the development of SDH due to age-related cerebral atrophy that causes brain volume reduction and extra-cerebral volume increase allowing blood collection after a minor trauma

in elderly individuals.[3,23] Clinical presentation varies from mild symptoms such as headaches and nausea to episodes of serious effects such as seizures and loss of consciousness.[24] Focal neurological deficits may also be found in some of these patients and can be the presenting complaint.[3,19]

Patients with SDH can be managed using various treatment options including conservative management.[8] Surgical evacuation remains the gold standard treatment for symptomatic chronic SDH (cSDH), though the optimal surgical approach is debated.[3,11,19,23] While various techniques exist, including craniotomy, twist drill craniostomy, burr hole drainage, percutaneous subdural tapping, and endoscopy, burr-hole craniostomy is often favored due to its low risk of recurrence and complications.[15] The most common practice involves surgical hematoma removal, drainage tube placement, and continuous drainage to prevent re-accumulation.[3,11,19,23]

Studies suggest that subdural drains after burr-hole drainage for cSDH reduce recurrence and improve outcomes, but their optimal placement remains debated.[3,11,23] While subdural drainage placement is common, concerns about complications such as brain injury and seizures exist.[11] Subgaleal drainage has emerged as a potential alternative, with some studies suggesting comparable effectiveness and a potentially better safety profile, prompting some institutions to switch from subdural to subgaleal drains.[3,11,19,23] Recent guidelines suggest routine insertion of a temporary drain, either subdural or subgaleal, whichever is safely possible,[24] implying that either is acceptable.

The guidelines, which suggest equivalence, are often based on randomized controlled trials or systematic reviews of populations selected using strict criteria.[24] This Scottish cohort, with a mean age of 75 and a mix of acute and chronic cases, differs considerably from such populations.[1,15] Most large multi-center studies originate from diverse geographical areas with varying baseline comorbidities, anticoagulant use rates, and healthcare systems, which may not apply to aging Western cohorts[1,10] because frailty and multimorbidity are increasingly recognized as major factors influencing surgical outcomes and may have a greater impact than drain type.[10,18]

Therefore, choosing a specific drain type mainly depends on safety and complication rates,[15] such as seizures, infections, and pneumocephalus.[10,15] Although recurrence and reoperation are consistently reported, the prevalence of seizures, infections, pneumocephalus, and functional decline has not been systematically compared across drain types.[12] In addition, hospital length of stay (LOS) and discharge destination, which directly impact healthcare efficiency and resource use, remain underreported.[3,11,19,23] Showing that subgaleal drains do not negatively affect discharge times supports using this less invasive option, based on real-world evidence from a single UK neurosurgical center that mainly serves an elderly, multimorbid population.

Objectives

This study aimed to evaluate and compare the above-mentioned postoperative outcomes in patients receiving subdural versus subgaleal drains after SDH surgery at Aberdeen Royal Infirmary (ARI). The primary objective was to explore equivalence in drain types at a single UK center. In addition, the study aimed to provide pilot data to inform the design of future large-scale randomized controlled trials assessing specific aspects of drain placement as detailed below.

MATERIALS AND METHODS

Study design

A retrospective analysis was conducted on all patients presenting with SDH to the ARI Neurosurgery Department between October 16, 2022, and August 31, 2024. Patients were followed from the time of surgery until the start of data collection on October 29, 2024. Data were collected by 2 early-year residents between October 29 and December 12, 2024. The study adhered to ethical standards for clinical audits.

Participants

Patients were identified using departmental surgical records and local procedure codes for SDH operations. Neurosurgical operation notes were reviewed to confirm diagnosis and procedure type. Only patients with SDH were included; no further exclusions were applied at this stage.

Variables and data sources

Data were extracted from operative notes, clinical records, radiological reports, and discharge summaries. Variables included demographics, comorbidities, prior SDH, antithrombotic use, pre- and postoperative neurological examination, modified Rankin scale (mRS) scores, SDH characteristics (acuity, laterality, depth, and midline shift), surgical technique, drain type and duration, complications (infection, seizures, pneumocephalus, hydrocephalus, recurrence, drain displacement, scalp swelling, and over-drainage), mortality, secondary operations, length of hospital stay (LOS), discharge outcomes, and presence and management of subdural membranes.

Bias

All eligible patients undergoing SDH surgery during the study period were included to minimize referral and selection bias. Surgical techniques remained consistent throughout the study period. Missing data were supplemented from clinical notes or imaging to reduce bias. To avoid confounding,

patients with acute SDH were excluded from the main analysis due to their distinctive clinical course.

Data adjustments

Numerical variables (age, Glasgow Coma Scale [GCS], mRS, power, SDH depth, midline shift, drain duration, and hospital stay) were rounded to whole numbers. For bilateral SDH, the largest depth was recorded. For patients with multiple admissions, hospital stay was summated. Four acute SDH cases without drains were excluded prior to analysis. Multimorbidity was defined as two or more organ systems affected, excluding alcohol, substance misuse, and prior SDH. Power was recorded for the most affected body region.

Statistical methods

Statistical analysis was performed using Microsoft Excel for basic demographic evaluation and R Studio for univariate and multivariate analyses. Categorical variables were summarized by reporting the number of patients in each category, while numerical variables were described using mean, median, and mode. Univariate analyses assessed associations between antiplatelet or anticoagulant use and hemorrhage recurrence, as well as between drain type and outcomes, including recurrence, infection, pneumocephalus, seizures, and length of hospital stay. Due to the small sample sizes in contingency tables, Fisher's Exact was employed instead of the Chi-square test. Subgroup analysis was performed for patients with subdural membranes. No statistical analysis was conducted for the acute SDH subgroup (n = 8), as they were excluded from the study.

Multivariable analysis was not performed because it would result in overfitting and biased estimates due to an unacceptably low events-per-variable (EPV) ratio.[20]

In this study, the least common complication, postoperative infection, occurred only 4 times. According to the widely accepted rule of thumb for statistical analysis, recommending a minimum EPV ratio of 10 for reliable multivariable logistic regression, our sample size could only support 0.4 covariates (4/10) in the model.[20] Even for our most frequent adverse event, recurrence (11 events), we could only include a single covariate alongside the primary predictor (drain type), which would still be statistically underpowered and unable to account for important confounding variables (e.g., age, anticoagulants, antithrombotics, and hematoma type).

Furthermore, based on a priori calculations, the estimated statistical power for detecting a significant difference in a model including three main covariates was only 40–50%, which further confirms a high risk of a Type II error (false negative) and model instability.

RESULTS

A total of 64 patients with SDH were identified during the 2-year study period. After excluding 9 with acute SDH, 55 patients remained for analysis (n = 55). The mean age was 75 years (range 22-87, standard deviation [SD] ± 10.93); 48 (87.3%) were male and 7 (12.7%) female. Alcohol was involved in 5 cases (9.1%), and other substances in 1 case (1.8%). Most patients (38; 69.1%) were multimorbid, and 13 (23.6%) had a prior conservatively managed SDH. Pre-existing antithrombotic use included clopidogrel (3; 5.4%), aspirin (10; 18.2%), warfarin (3; 5.4%), rivaroxaban (2; 3.6%), and edoxaban (1; 1.8%). Mean preoperative GCS was 14 (median 15), and mean preoperative limb power was 3.9/5 (n = 49). Higher cognitive dysfunction was present in 26 (47.3%) patients. The mean pre-SDH mRS was 1.7.

Of the 55 cases, 9 (16.4%) were subacute, 15 (27.3%) acute-on-chronic, and 31 (56.4%) cSDH. Mean maximum preoperative SDH depth was 25 mm (n = 51), and mean preoperative midline shift was 10 mm (n = 50). SDH was bilateral in 8 cases (14.5%), left-sided in 28 (50.9%), and right-sided in 19 (34.5%). Postoperative imaging (n = 46) showed mean SDH depth reduced to 14 mm and midline shift to 5 mm. Most patients had evacuation through two burr holes (41; 74.5%), with others undergoing bilateral burr holes (6; 10.9%), mini-craniotomy (7; 12.7%), or craniotomy (1; 1.8%). No patients underwent MMA embolization in this group. This is not routinely performed in Aberdeen, and patients needing this procedure are transferred to Edinburgh Royal Infirmary.

Drains were used in all cases: 23 (41.8%) subgaleal and 32 (58.2%) subdural. The decision to place a subdural or subgaleal drain at surgery was at the discretion of the surgeon. Mean drain duration was 2 days (range 1–4, SD ± 0.52). Postoperative, mean GCS was 14 and mean limb power 4.6/5. Complications included infection (4; 7.3%), seizures (8; 14.5%), and pneumocephalus (36/49; 73.5%). All cases of pneumocephalus were identified radiologically, and none were clinically significant. Some patients may have received supplemental oxygen based on their imaging findings; however, detailed numbers were not examined as part of this study. No cases of hydrocephalus, drain displacement, or over-drainage occurred. Six patients (10.9%) died in the follow-up period of this study. Two patients (3.6%) died 4 and 5 months later from sepsis and pulmonary edema unrelated to the SDH, respectively. Two patients (3.6%) died about a month after their initial operation, one (with initial subgaleal drain) from developing empyema which was further evacuated (and new subgaleal drain inserted); however, patient has not managed to recover despite this and antibiotics. The other (with initial subgaleal drain) passed away a month later on a recover ward, likely from a combination of COVID infection and worsening

dementia. Fifth patient passed away 16 days after the original operation (subdural drain), when they experienced mild re-accumulation of SDH; however, in view of other morbidity, it was agreed that no further surgical intervention was appropriate. Last patient passed away 5 days after the initial operation (subdural drain), when they experienced a re-bleed and in view of view of other morbidities, it was also decided that no further surgical intervention was appropriate.

SDH recurred in 11 (20%) patients, all of whom underwent repeat surgery. Recurrence was identified in patients who were re-presented with further clinical deterioration after SDH management, resulting in further imaging and repeat surgery in all 11 cases. Five (45.5%; 9.1% of 55 patients) had an initial subgaleal drain, 6 (54.5%; 10.9% of 55 patients) an initial subdural drain. Their mean maximum SDH depth was 22 mm, and mean midline shift 8 mm. Repeat procedures included two burr holes (6; 54.5%), bilateral burr holes (1; 9.1%), mini-craniotomy (1; 9.1%), and craniotomy (3; 27.3%). Drains were used again in 4 cases (36.4%) subgaleal, and in 7 cases (63.6%), with an average duration of 2.6 days. Three (27.3%) patients with a subgaleal drain during the first operation received a subdural drain at the second surgery. Two (18.2%) patients with a subdural drain initially had a subgaleal drain inserted during the second operation. The remaining 6 (54.5%) patients had the same type of drain during both procedures (two subgaleal, four subdural). No further rebleeds occurred in this group.

Median hospital stay was 7 days. At discharge, mean mRS was 2.5; 30 (54.5%) patients had unchanged mRS, while 25 (45.5%) had worsened scores. Most patients (36; 65.4%) were discharged home; others went to community hospitals (7; 12.7%), rehabilitation (4; 7.3%), nursing care (2; 3.6%), or palliative care (1; 1.8%). Three (5.5%) patients died before discharge. Mean discharge GCS and limb power were both 15 and 5/5, respectively.

Seventeen (30.9%) patients had intraoperative subdural membranes found; 16 (94.1%) were cleared at the primary operation. Five of these (29.5%) patients had SDH recurrence. Drain type and surgical approach varied within this subgroup.

No significant associations were found between SDH recurrence and pre-SDH antiplatelet (P = 0.27) or anticoagulant (P = 1) use. No significant links were identified between drain type and SDH recurrence (P = 0.75), infection rates (P = 0.63), pneumocephalus (P = 0.76), or seizures (P = 0.12). Drain type was not associated with hospital stay after excluding acute SDH cases (P = 0.14). The presence of membranes was not significantly related to recurrence (P = 0.29), nor was drain type within this subgroup (P = 0.60). Full statistical details are summarized in Tables 1-3.

Table 1: Patient demographics.

Total cases (%)	55 (100%)
Age (years) (Mean±SD) (Range)	75±11.03 (Range 22-87)
Male (%)	48 (87.3%)
Female (%)	7 (12.7%)
Alcohol use (%)	5 (9.1%)
Substances use (%)	1 (1.8%)
Multiple comorbidities (%)	38 (69.1%)
Previous conservative management (%)	13 (23.6%)
Anticoagulation use (%)	6 (10.9%)
Antiplatelets use (%)	13 (23.6%)
Pre-op GCS (Mean±SD) (Range)	14±1.26; (Range 8-15)
Pre-op Motor score (Mean±SD) (Range)	3.9±0.87 (Range 1-5)
Higher cognitive dysfunction (%)	26 (47.3%)
Pre-SDH mRS (Mean±SD) (Range)	1.7±0.78 (Range 1-4)

SD: Standard deviation, SDH: Subdural hematoma, GCS: Glasgow Coma Scale, mRS: Modified Rankin scale

DISCUSSION

ARI neurosurgery, though considered a smaller unit, actually caters to the largest catchment population in the UK. It serves approximately 800,000 people in the North East of Scotland, covering the Grampian, Highlands, and Northern Isles regions. Recent literature on the utility of subdural or subgaleal drains is at equipoise,[24,27] while other studies suggest that it is not the drain type but age >80 that predicts worse outcomes.[10] This study aimed to evaluate the effectiveness of the two drain types, address gaps in existing literature by analyzing a Scottish cohort with a mean age of 75 years presenting with a mixed acute/cSDH, and determine whether their outcomes after SDH management differ from those reported elsewhere.

By comparing recurrence rates and other postoperative complications stratified by drain type and age, this study evaluates functional outcomes and hospital LOS. This analysis offers a broader understanding of the risks and benefits associated with each method, which can further assist in choosing a specific drain type based on patient characteristics. It builds on existing trials and meta-analyses while placing drain choice within the context of current neurosurgical practice. The results support the idea that both drain strategies are generally comparable in safety and effectiveness,[3,6,9] while emphasizing the importance of tailoring surgical decisions based on individual patient factors, surgeon expertise, and institutional protocols.

Therefore, this retrospective study evaluated postoperative outcomes in 55 patients who underwent surgical evacuation of SDH at ARI over a 2-year period, stratified by drain type.

Table 2: Characteristics associated with SDH.

Subdural type	Subacute (Age Mean±SD) (Age Range)	9/55 (72±10.25) (Range 55-85)
	Acute-on-chronic (Age Mean±SD) (Age range)	15/55 (74±15.99) (Range 22-87)
	Chronic (Age Mean±SD) (Age range)	31/55 (77±4.48) (Range 50-87)
Laterality	Bilateral (%)	8 (14.5%)
	Left (%)	28 (50.9%)
	Right (%)	19 (34.5%)
SDH features	Max depth pre-op (mm) (Mean±SD) (Range)	25±6.74 (Range 8-40)
	Midline shift pre-op (mm) (Mean±SD) (Range)	10±4.48 (Range 0-18)
	Max depth post-op (mm) (Mean±SD) (Range)	14±4.71 (Range 3-25)
	Midline shift post-op (mm) (Mean±SD) (Range)	5±3.47 (Range 0-15)
Procedures performed	Burr holes (%)	41 (74.5%)
	Bilateral burr holes (%)	6 (10.9%)
	Mini-craniotomy (%)	7 (12.7%)
	General craniotomy (%)	1 (1.8%)
Drain type	Subgaleal drain (%)	23 (41.8%)
	Subdural drain (%)	32 (58.2%)
Post-op features	Drain duration (Days) (Mean±SD) (Range)	2±0.52 (Range 1-4)
	GCS (Mean±SD) (Range)	14±1.53 (Range 7-15)
	Motor score (Mean±SD) (Range)	4.6±0.60 (Range 3-5)
	Infection (%)	4 (7.3%)
	Seizure (%)	8 (14.5%)
	Pneumocephalus (*n*=49/55) (%)	36 (73.5%)
	Scalp swelling (%)	2 (3.6%)
Postop recurrence	Drain displacement (%)	0 (0.00%)
	SDH recurrence (%)	11 (20%)
	Max depth (mm) (Mean±SD) (Range)	22±9.76 (Range 4-41)
	Midline shift (mm) (Mean±SD) (Range)	8±3.53 (Range 4-13)
Secondary procedures for recurrence (*n*=11/55)	Burr holes (%)	6 (54.5%)
	Mini-craniotomy (%)	1 (9.1%)
	General craniotomy (%)	3 (27.3%)
	Subgaleal drain (%)	4 (36.4%)
	Subdural drain (%)	7 (63.6%)
	Drain duration (days)	2.6±1.43 (Range 1-6)

SD: Standard deviation, SDH: Subdural hematoma, GCS: Glasgow Coma Scale

The cohort included 9 subacute, 15 acute-on-chronic, and 31 cSDH cases, with a mean age of 75 years (48 males and seven females). Of these, 23 patients received subgaleal drains and 32 received subdural drains, with a mean postoperative drain duration of 2 days. The decision to place a subdural or subgaleal drain during surgery was up to the surgeon's discretion. The nearly even split, however, was accidental. No other reasons for this ratio were identified. Key outcomes included 11 SDH recurrences, four postoperative infections, eight seizures, 36 cases of pneumocephalus, two cases of scalp swelling, and one SDH-related death. The mean hospital stay was 9.5 days. Importantly, there were no statistically significant differences between subgaleal and subdural drains regarding SDH recurrence, infection, pneumocephalus, seizure incidence, or length of hospital stay, findings consistent with the literature.[3,6,9,21,23,26]

The placement of a drain after burr-hole evacuation is fundamental to cSDH management and is vital for preventing recurrence, as shown in large multi-center studies.[5] While the protective benefit of drainage itself is well proven, the optimal anatomical site for placement remains debated.[3,11,19,23] Existing studies and meta-analyses generally report no significant differences in recurrence or reoperation rates between subdural and subgaleal (subperiosteal) drains.[12] A recent *post hoc* trial with 361 patients reported reoperation rates of 23.83% for subgaleal drains and 22.22% for subdural drains.[11] In addition, a meta-analysis of 4,318 patients found that the odds ratio (OR) for recurrence was 1.08 ($P = 0.56$),[3] and an analysis of 13 studies involving 3,619 patients showed a relative risk of 0.98 ($P = 0.92$).[23] Recently, published guidelines recommend that "Surgery should include the placement of a temporary drain, either subdural or subgaleal where safe to do so,"[13] advocating for routine placement of drains, stating that both methods are suitable.

In their most extensive meta-analysis of 455 studies that included 103645 patients, Henry *et al.* found that although drains reduce the risk of SDH recurrence, the type of drain, subgaleal versus subdural, did not influence the recurrence.[12] Nonetheless, the evidence shows considerable variation in surgical techniques, patient populations, and outcome reporting, which limits the broader applicability of these findings.[3,11,12,19,23] Importantly, outcomes appear to be influenced by the drainage mechanism itself.[6] Recent analyses suggest that passive drainage systems are superior to active suctioning in preventing recurrence.[7] Wherever active suctioning is utilized, low-pressure regimens are favored to maintain safety and efficacy.[4]

However, a systematic review and meta-analysis of more than 3,300 patients by Grueter's team found that subperiosteal or subgaleal drains had significantly lower rates of drain misplacement, parenchymal injury (1.2% vs. 7.8%; $P = 0.0001$), and recurrence (11.9% vs. 12.3%; $P = 0.02$),

Table 3: Statistical significance analysis.

Association type	Variable	Odds Ratio	95% CIs	*p*-value
Recurrence	Antiplatelets	0.27	0.006-2.307	0.27
	Anticoagulants	0.78	0.015-8.263	1.00
	Membranes	2.18	0.441-10.544	0.29
	Membranes' drain type	1.91	0.110-28.290	0.60
	Overall drain type	0.76	0.141-3.505	0.75
Other complications by drain type	Infection risk	0.45	0.008-5.987	0.76
	Pneumocephalus	1.27	0.296-5.979	0.76
	Seizure incidence	0.17	0.003-1.466	0.12
	Length of hospital stay	Z = -1.47	-0.502-0.076	0.14

SD: Standard deviation; *P*-value significance threshold $P<0.05$

although mortality and long-term clinical outcomes were similar.[9] This finding is supported by a 2019 randomized clinical trial, which showed that subperiosteal drains resulted in fewer recurrences than subdural drains, although the difference was not statistically significant. Importantly, it also led to fewer brain injuries.[22] In addition, a multi-center cohort study analyzing outcomes across 11 institutions reported similar recurrence rates between subdural and subperiosteal drains.[27] Our findings align with these observations, as we found no significant differences in recurrence or morbidity between the two drain groups. We also did not encounter any serious side effects, such as parenchymal hemorrhage caused by drain misplacement, although the study lacked enough power to detect such differences.

The critical issue of drain safety has been emphasized especially in Scandinavian literature. Clinical audit data support the necessity of adopting standardized protocols to bridge the gap between evidence and practice.[25] A study from Denmark introduced a nationally standardized technique for subdural drain insertion, using short, multi-channel soft silicone spiral drains and a careful deployment method aimed at reducing cerebral injury.[13] Their experience, applied across all neurosurgical centers since 2018, shows that adopting a uniform technique can reduce the risk of parenchymal injury from subdural drains. This technique has also been debated regarding the timing of drain placement.[2,13] This approach contrasts with other studies, which reported misplacement rates of up to 15–17% when drains were inserted directly into the subdural space, particularly with stiffer drain types and inconsistent techniques.[9,13]

Other studies have noted that patient-related factors, such as age and comorbidities, rather than the drain type alone, significantly influence SDH evacuation outcomes. In a subgroup analysis of the randomized cSDH-drain trial, outcomes in patients aged 80 years and older were influenced more by age and comorbidity than by drain type.[10] A sub-analysis of the same RCT found advanced age, preoperative midline shift, bilateral cSDH, and the use of antithrombotic medication to be the independent risk factors for recurrence.[17] While recurrence rates were similar between subdural and subperiosteal drains, misplacement was substantially higher in the subdural group (20% vs. 0%). This data supports the preferential use of subperiosteal drains in the elderly, frail, and those on anticoagulation, where minimizing intracranial manipulation is particularly important. In our cohort, the mean age was 75, with 23 patients over the age of 80. Drain type was not significantly associated with recurrence (OR = 0.96, $P = 1$).

Furthermore, a matched cohort study evaluating outcomes in patients ≥85 years found that, after propensity-matching for comorbidities, postoperative complications, recurrence, and functional outcomes were comparable to those of younger elderly patients (65–84 years).[18] Similarly, a multicenter study of 101 patients demonstrated that even in nonagenarians and centenarians, surgical evacuation of cSDH was associated with acceptable morbidity and mortality, with survival and functional recovery rates supporting surgical intervention despite extreme age.[16] When considered alongside our cohort, these findings reinforce that advanced age alone should not preclude surgical treatment. Instead, outcomes appear to be driven primarily by frailty and baseline health status, with drain type conferring a secondary influence. Taken together, this suggests that selecting a drain strategy that minimizes procedural risk (e.g., subperiosteal placement in the very elderly or anticoagulated) may optimize safety without compromising efficacy.

A complex subgroup with increased perioperative risk includes patients presenting with cSDH who are also on antithrombotic or anticoagulant therapy. In our current study, specific data regarding the timing of anticoagulant reversal and postoperative resumption were unavailable for analysis due to the retrospective nature of the dataset and changes in prescription recording systems. We recognize that managing perioperative hemostasis is a critical variable that

may influence recurrence rates. This interaction was notably examined in a sub-analysis of an RTC in 2020.[14] The study assessed the effectiveness of subperiosteal versus subdural drains specifically in patients undergoing anticoagulation or platelet inhibitor therapy. The results showed that although this group carries a higher baseline risk, the choice of drain placement (subperiosteal versus subdural) did not result in a statistically significant difference in recurrence or mortality within this specific subgroup.[14] This indicates that the mechanical benefit of postoperative drainage remains strong even with antithrombotic therapy, although future prospective studies should aim to stratify outcomes based on precise resumption protocols to further optimize management strategies.

In addition, postoperative hematoma size, either immediately or on follow-up imaging, was also not influenced by the drain type.[9,11] Our data, though limited by inter- and intra-rater variability in radiological assessment, agree with these findings.

Clinical outcomes, as measured by the mRS, are generally favorable in the literature, with approximately 90% of patients achieving good functional outcomes.[23] However, few studies address hospital LOS. In our initial analysis, subdural drains appeared to be associated with shorter hospital stays, but this effect was confounded by including acute SDH cases, all of whom had received subgaleal drains, had longer LOS, and higher mortality. Excluding these acute cases eliminated the observed differences.

Mortality rates also did not differ by drain type, which aligns with recent meta-analyses and large-scale studies.[3,23] Recurrence, when it occurs, typically manifests within the first 2 weeks post-surgery.[17] In our cohort, there were six deaths; one caused by SDH, another from subdural empyema, and four were unrelated to their primary condition. Other complications, including postoperative infection, seizures, and pneumocephalus, also showed no significant differences between drain types in our study, mirroring findings noted in the literature.[3,23]

Taken together, our data and the broader evidence suggest that both subdural and subperiosteal drains are effective and generally equivalent, with no consistent differences in recurrence, mortality, or functional outcomes.[22,27] Subperiosteal drains seem to carry lower risks of drain-related parenchymal injury and infection, especially in the elderly or anticoagulated populations.[9,10] However, carefully standardized techniques for subdural drain placement, as developed in Denmark, could reduce many of these risks.[13]

Therefore, the choice of drain should be based on patient circumstances, surgeon familiarity, institutional experience, and intraoperative findings. Centers with established standardized approaches to subdural drain insertion report excellent safety profiles, while for higher-risk patients, subperiosteal placement may offer advantages.

The main limitation of this study is its single-center, retrospective design, and small sample size (n = 55), which increases the risk of a type II error. Although we used appropriate non-parametric statistical methods (Fisher's Exact Test and Mann–Whitney U-test) to obtain accurate p-values, the study lacks the statistical power to definitively exclude a small but clinically significant difference between the two drain types. Therefore, the conclusion of "no significant difference," although consistent with existing literature on their equivalence, should be interpreted with caution. It is only preliminary data intended to inform the design of future large-scale randomized controlled trials. In addition, including all acute SDH cases that received subgaleal drains could further confound comparisons. Moreover, the absence of routine postoperative imaging might have led to missed asymptomatic drain misplacements, a problem also noted in other series.

CONCLUSION

This 2-year retrospective data review found no significant differences in postoperative outcomes and complications, including SDH recurrence, SSI, pneumocephalus, seizures, and LOS, between subgaleal and subdural drains in the Scottish cohort undergoing surgery for cSDH. These findings support current recommendations that either drain type is suitable. The choice should be individualized based on patient and intraoperative factors. Larger, prospective studies are necessary to better determine the optimal strategies for managing SDH.

Ethical approval: The Institutional Review Board approval is not required as it is retrospective study.
Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.
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